Cyberdent:
Dental Information Processing
Newsletter

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CYBERDENT
DENTAL INFORMATION PROCESSING NEWSLETTER

Volume 5, Number 2
Summer 1977

A New Role for the Dentist

Some of the latest developments in computer technology have suggested a new role for the dentist of the future. Lawrence R. Zeitlin, writing in Datamation magazine ("The Ultimate Personal Computer", p. 131, 132, and 137, May 1977), suggests the possibility of the dentist implanting a computer in the space left when a "wisdom" tooth is removed.

Zeitlin has extrapolated the size of a college text to estimate the bit requirements for a college education as being about 1.15 times 10^9 bits which in the currently available solid state memory technology would require a space of 6.6 cubic inches, or about the same as a pack of cigarettes.

By using coded English phonemes he estimates that the storage needs could be reduced by nearly 50 percent, or an area of 3.7 cubic inches.

Present commercial announcements of market offerings of bubble memory devices speak of 92,000 bits per chip, some 22.5 times as space-efficient as solid state technology. By applying this approach, Zeitlin figures that a college education could be stored in a space of 0.17 cubic inches or about three cubic centimeters (cc). This is small enough to fit into a tooth, and he suggests that the dental inlay of the future might contain a college education. Think of it - a bachelor's degree in a premolar, a masters in an incisor, or a Ph. D. in a molar.

Undoubtedly, as the trend toward minaturization of memory and CPU's continues, enhancements of this idea will be conceivable. A roundhouse bridge or a full denture could be a complete library.

As the microcomputer has become available at very low prices and in very small sizes, a main drawback has been the lack of reduction in size and cost of input and output devices. Zeitlin suggests that the mouth may be the ideal place to locate these memory and CPU components.

His ideas are fascinating, as seen in these quotes, "We tolerate foreign bodies in the mouth quite well... The mouth is temperature controlled and serves as an effective heat sink. This location for the computer facilitates input/output communication, a piezoelectric crystal picking up the vibrations of speech and responding via bone conduction to the ear."

"Indeed the saliva could act as an electrolyte for a wet cell which generates the power for operation. The only unusual design requirements are that the device be waterproof, shockproof, and nontoxic."

"...is this really an education?"

"The answer is an unequivocal NO -- and an unfortunate YES.

"It is really no more of an education than handing a student an armful of textbooks and granting him his degree; but, the latter is a fair characterization of present educational practices, and the inlay wouldn't be much worse."

"Education, as we conceive of it today, may be considered a communications channel which conveys information from the printed page to the gray matter of the brain. Since the communication channel has such a low data rate and the brain's retention process is so inefficient, a prodigious amount of time must be spent in information transfer. If we assume that a student spends 40 hours a week for 9 months of each academic year reading the 3.1 X 10^7 words representing a college education, he has a data input rate of approximately 58 bits/second."

"Juding by the typical performance on examinations, only about 1/10 of this information is retained, resulting in an effective transmission rate of six bits/second from the printed page to the brain."

"An oft-spoken criticism of contemporary education is that so much time is spent in the accumulation of information, that very little time is available to explore the use of that information. The direct implantation of data would solve that problem in a single stroke and could allow the educational process to direct itself to the integration and understanding of information rather than the accumulation of facts. In this respect the personal computer represents a potential technological breakthrough in education roughly on a par with the invention of moveable type."

"With the implantable computer it may ultimately be possible to change one's occupation with every visit to the dentist. Perhaps even do-it-yourself preprogrammed

(see NEW ROLE, page 2)

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CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

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CYBERDENT is published quarterly. News and comments should be sent to the Editor. Circulation inquiries are to be directed to Ms. Karen Scarlett at the same address. Publication is funded by subscription and by the following sponsors:

NORTHWESTERN UNIVERSITY
WEST VIRGINIA UNIVERSITY
UNIVERSITY OF TEXAS HEALTH SCIENCE
  CENTER AT HOUSTON
UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
DENTAL DATA CENTER

MEDICAL PROFESSION USES DP TO AID DIAGNOSIS

SYSTEM PINPOINTS PATIENTS WITH PULMONARY PROBLEMS

The medical profession is increasingly turning to data processing for more effective means of diagnosis and treatment.

Doctors treating heart and lung diseases can obtain advice from Methodist Hospital's computer system in Houston to evaluate a patient's heart and lung condition.

The IBM 360/65 running under the CICS environment, is programmed with heart and lung data for healthy persons of various physical types and conditions. Statistics on age, weight, medical history and other pertinent facts are kept on-line in the data bank for comparison with input data on a particular patient.

To diagnose a patient, physicians put him through a number of standard procedures which determine inhalation/exhalation capacity, according to R. E. Wimberley, DP director. The patient's performance is rated and input via a dial-up terminal in a conversational interactive mode, he said.

The system will compare those results with a person of similar characteristics but normal pulmonary activity. After comparison, the system will ask for additional testing, if necessary, or recommend therapy for the patient.

Pulmonary rate variations between the patient and the prototype are output in three forms. One form includes computational figures on pulmonary rates.

The second is an air-flow volume diagram consisting of graph curves plotted to reproduce flow of air to lung cavities over time and a comparison with the norm.

The third format is a written English summary of the patient's condition.

The program took five years of medical research to complete and is currently accessed remotely by 18 other hospitals. □

NATIONWIDE NETWORK

COMPUTER HELPS PREVENT ADVERSE DRUG REACTIONS

A nationwide computer network is being established to advise doctors of possible adverse drug reactions in patients.

Using terminals linked to a central computer, physicians, pharmacists and scientists can determine the effects of more than 12,500 prescription and non-prescription drugs. If a patient has suffered a drug reaction, a doctor can enter symptoms and receive a list of drug interactions which might be the cause.

Called the Computer Based Drug Information System, the project is joint effort of the Information Science Group and the Medical Computer Center of the University of Missouri School of Medicine. The project is partly funded by the U.S. Public Health Service.

Terminals are located in hospitals, pharmacies and nursing homes in major metropolitan areas such as Washington, DC, Chicago, Detroit, St. Louis and Kansas City.

Ther terminals are linked to an IBM System 370 model 168 computer at the University of Missouri, where researchers gather and store drug information from actual clinical data and experimental evidence. Data on precautions, adverse effects, preparations, dosage misture and other factors are supplied in part by the Food and Drug Administration's Bureau of Drugs.

To use the system, the health care professional enters names of drugs and asks for the effect of their interaction. The computer prints out the information on clinical implications, experimental evidence (in text form) plus references for further study. □

(NEW ROLE, from page 1)

memories might be made available to such selected specialties as law and medicine as a substitute for postgraduate education."

"When I first started this little paper, my tongue was firmly lodged in my cheek. But, come to think of it, everything I have suggested is either within the state of the art today or is likely to be so before this decade is out. The technology is here and the economic impetus is positive. Indeed, the personal computer capability suggested is not the ultimate individual system but rather an interim step. The ultimate computer might well be the size of a grain of sand implanted in the brain at birth and as accessible to the brain as any other neuron."

Third molars have been commonly called "wisdom teeth" for a long time. Perhaps this was because they most frequently erupt at an age when a person reaches maturity or majority. If Zeitlin's ideas come to fruition, then every tooth may become a wisdom tooth, and the dentist will indeed have a new role to play in society. □

Zeitlin is professor of Industrial and Organizational Psychology at Baruch College of the City University of New York. He is also president of Lakeview Research, Inc., a consulting firm. □

OPERATION RESEARCH LISTS STUDIES OF HEALTH PROBLEMS

The following are abstracts of papers read at the TIMS/ORSA meeting held in San Francisco, May 9-11, 1977. They were selected because of their topical relation to health care problems.

COST-EFFECTIVENESS STUDIED

Evaluating Cost-Effectiveness of Ambulatory Health Care Delivery for Chronic Diseases; Case Studies for Hypertension and Diabetes Mellitus, GAIL S. LASDON. Since chronic diseases are never resolved, the goal of therapy is to maximize the percentage of time a patient's disease is under control. Using abstracts of patient encounters, the ongoing treatment process is divided into episodes of care based on whether the disease is controlled or uncontrolled according to clinical criteria. Utilization statistics for each episode type are used to calculate the cost of resources and compare cost-effectiveness among settings. The impact of patient characteristics on disease control and utilization of resources is assessed. The use of this method for evaluating alternative delivery modes is demonstrated.

Dr. Gail S. Lasdon
National Center for Health Services Research
Health Resources Administration
Rockville, MD 20852

REMOTE SLOW SCAN T.V.

Slow Scan T.V. in Health Care Delivery to Remote Areas, WILLIS T. RASMUSSEN and JOHN SILVA. There are many areas throughout the United States where health care delivery is not readily available, and in particular, where no physicians are available. Physician's assistants, or paramedics, are being utilized more for health care delivery to these areas. Current technology makes it feasible for a paramedic at a remote location to be able to transmit medical data, such as physiological telemetry and video data (e.g., x-rays) to a physician at some central location. This paper discusses the role and requirements of slow scan video as an integrated component of a health care delivery system for remote areas.

Dr. Willis T. Rasmussen
Naval Electronics Laboratory Center
Biosystems Engineering Branch (Code 3430)
San Diego, CA 92152

MIS FOR MEDICAID

Planning a Management Information System for Medicaid, STEVEN S. LAZARUS, HENRY A. FOLEY, ROBERT F. GREENE, JR., and GARRY A. TOERGER. The Medicaid Management Information System (MMIS) concept was developed by the Department of Health, Education, and Welfare; Social and Rehabilitation Service under Public Law 92-603, enacted on October 30, 1972. This program provides both financial and administrative advantages to state governments which adopt it; with the prospect of improving the information base and the management of State and Medicaid programs. The six MMIS sub-systems are: Claims processing, privder, recipient, reference file, surveillance, and utilization review, and management administrative reporting system. The state of Colorado has developed a plan for implementing MMIS with all six sub-systems and a computerized prospective rate setting sub-system to be used for both hospitals and nursing homes. The plan for implementing MMIS was developed by an inter-disciplinary team including the Colorado Medicaid program director, the director of the data processing facility which would process the data, top management of the Department of Social Services, and an operations research consultant. The integrated management project team has effectively utilized both administrative and technical skills in developing a plan for implementing this major computer system for the Colorado Medicaid Program.

Dr. Steven S. Lazarus
College of Business Administration
University of Denver
Denver, CO 80208

POLITICS OF HEALTH CARE

Observations on the Political Economy of Health, DAVID H. STIMSON and RUTH H. STIMSON. A popular thesis put forth by certain influential social scientists is that additional expenditures for medical care in the United States will do little to improve the health of the American people. They hold that the life styles of individuals are a major cause of medical problems. As a result, they believe that the greatest potential for improvement lies in getting individuals to change habits that affect their health. Among the many things that this argument ignores or blurs is the impact on health of the economic and social system of the United States of which the health care system is a part.

Dr. David H. Stimson
School of Medicine
University of California
San Francisco, CA 94143

CONTRACTS FOR HEALTH

The Role of the Individual in the Health Care System, CHARLES E. LEWIS. This paper describes projects currently being conducted by the U.C.L.A. Center for the Health Sciences. Included are studies of the impact of social contracts on compliance with recommendations for care, the development of a health edcuation curriculum that involves children actively in the learning process in the classroom, a broader field trial of the child-initiated care system within a Public School System, and others. The rationale for concern with giving patients a more active role with regard to their own health care is discussed.

Dr. Charles E. Lewis
School of Medicine
U.C.L.A.
Los Angeles, CA 90024

Further information and perhaps copies of the complete papers may be obtained by writing to author at the address shown.

Membership information may be obtained from Operations Research Society of America, 428 East Preston Street, Baltimore, MD 21202. □

MONITORING OF CARDIAC CASES REDUCES MORBIDITY

In a recent presentation before the American Heart Association, Dr. Roy Jurado of Mt. Sinai Hospital in New York stated that "computerized surveillance can play a role in reducing morbidity in postoperative cardiac surgical patients."

Reporting the results of a 30-month study, Jurado noted computers were used to record some 35 different physiological variables during an average period of 37 hours following heart surgery.

The director of the Mt. Sinai Cardiac Surgical Intensive Care Unit related that of 120 patients monitored under the computerized system, only one had been lost, and that that loss had occurred because a human failed to react to the computer-generated warning signals. This compared favorably to the precomputer methods of patient monitoring.

Such news is good news, of course, and clearly demonstrates the humanitarian aspects of computing. At the same time, this news is very disquieting, for with the increased acceptance of such devices there exists the ever-present potential that the single patient lost from human disregard could just as easily be lost because of purposeful or accidental intent on the part of the equipment designers, the programmers or the systems installers.

Computerized surveillance systems, like many others, lack even the most elementary guarantees, inspections and accountability, according to Kenniston W. Lord, Jr. in Computerworld. □

CAI FOR BLIND STUDENTS PLANNED IN N.C. COLLEGES

MINIS AND VOICE SYNTHESIZER TO HELP TUTOR BLIND STUDENTS

RALEIGH, N.C. -- Blind students in North Carolina community colleges may soon whiz through their course requirements with the help of a small minicomputer and voice synthesizer linked to a larger mini, according to Computerworld.

Project Vocab -- vocal computer-aided instruction (CAI) -- is being funded by both state and federal agencies, according to Bill Ballenger, project manager for the North Carolina State University-based program.

It is designed to help blind students "overcome the handicap of not being able to see the chalkboard," he said.

Under both state and federal laws, blind students must be allowed to study at schools along with all other students, but course "bottlenecks" had been holding many students back, he added.

The project is designed at attach these "bottlenecks" -- accounting and DP -- courses which are requirements for most students enrolled in the community colleges.

When the project is completed, students will be able to tutor themselves in these subjects by typing data into a CRT and receiving voice response, he said.

Research for the project is being performed on a Wang Laboratories 2200T minicomputer with the help of a Votrax Voice Synthesizer from the Vocal Interface Division of Federal Screw Works, according to Ballenger.

The larger minicomputer presently used is a Hewlett-Packard Co. Access 2000 time-sharing system at Triangle Universities Computation Center, a service facility belonging to the University of North Carolina, Duke University, and North Carolina State University.

The researchers pay a flat rate for time on the system and access it through an ordinary acoustic couple line.

The researchers are not only writing the CAI texts for the tutored instruction, they are also writing the programs that drive the voice synthesizer. The voice response unit looks to the computer as though it were a standard peripheral, Ballenger noted.

Control codes indicate the data belongs to the Votrax, he added. A data switch detects when data is to be synthesized into speech through a process which produces words and phrases using phonemes -- basic sounds -- as building blocks, he explained.

The system produces the sounds and integrates them with inflection to produce speech, he said.

A program from the Naval Research Laboratories in Washington, D.C., is being used to translate the English text into speech, Ballenger said.

When completed, a basic Votrax, CRT and acoustic coupler will cost schools "under $10,000" excluding software, he noted. □

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hardware

CDC ADDS PLATO TERMINAL

MINNEAPOLIS -- Control Data Corp. has introduced a low-priced education terminal that reportedly features increased reliability and options.

The terminal is intended for use with the firm's Plato computer-based education system and costs 23% less than the previous Plato terminal; maintenance costs are 66% lower, according to CDC.

A primary feature is touch-screen response capability. Questions can be answered, images moved to different areas of the screen and new images displayed by the pressure of a fingertip.

Purchase price of the plato terminal is $6,800, regardless of quantity ordered compared to $8,800 previously. The touch-screen capability and a local interface modem are included in the purchase cost, the spokesman said.

The terminal is also available on a lease basis, with the monthly rates reflecting quantities ordered, the spokesman noted from CDC at Box 0, Minneapolis, Minn. □

AUDIBLE AND VISUAL ALERTS INCLUDED IN NEW SYSTEM

DRUG-INTERACTION COMPUTER SYSTEM FOR THE HOSPITAL PHARMACY

Focusing on potentially hazardous drug interaction, the new Spear Pharmacy Computer System 830 produces audible and visual alerts when such a prescription combination is ordered.

Routine system functions include; handling of admissions-discharge-transfer, medication order entry, scheduled medication preparation, PRN medications, intravenous admixtures, controlled substances, and a vareity of patient, management, billing, inventory, and statistical reports. On command, the apparatus classifies any harmful drug interaction, displays clinical significance and mechanism, and suggests appropriate treatment.

All interface with the pharmacist-designed computer is accomplished via CRT terminals using common, everyday English. Pharmacists can review on the unit's cathode ray tube (CRT) every drug order for a specified patient, making any modification desired.

The system can be implemented using several different hardware configurations including Four Phase, IBM 360/370, Data General Nova, and Honeywell. Spear Pharmacy System 830 is priced by B-D Spear Medical Systems at "under $100,000."

For more information, contact Donald W. Hawes, Manager, B-D Spear Medical Systems, Waltham, Massachusetts 02154. □

SCANNING TIME REDUCED TO ONLY FIVE SECONDS

THIRD GENERATION CT BODY SCANNER

A five-second scan is a feature of a new CT scanner developed by Searle and unveiled November 17 in Chicago by the annual meeting of Radiological Society of North America.

According to Searle CT Systems, its Pho/Trax 4000 body scanner scan time capability of five seconds is only one of a series of "third-generation multiple advances." It identifies other advances as; 40-second image reconstruction, variable slice thickness from 3mm to 12mm in 1 mm increments, and independent micro-processor-controlled diagnostic viewing console, image magnification, and substantailly lower patient radiation dose than with systems currently in wide-spread use.

Company general manager Dr. John Ashe said that the heart of the new system is a novel approach to x-ray source and detector technology, explaining: "The x-ray tube, rated at 30 milliamps, produces a continuous, non-pulsed, 40-degree, fan-shaped beam during the entire course of a single 360-degree rotation. This permits full use of the available photon flux.

"The fast scan time virtually eliminates blurred exposures from patient movement, allows breath-holding even with the seriously ill, and facilitates infant studies. Also, high processing speed means that six slices can be reconstructed in just four minutes, for example, while the next patient is being prepared for examination."

For more information, contact Dr. John Ashe, General Manager, Searle CT Systems, Box 1045, Skokie, Illinois 60076. □

PSYCHIATRIC PATIENTS LIKE CRT BETTER THAN M.D.

A majority of patients at the Veterans Administration (VA) Hospital in Salt Lake City would rather be interviewed by a computer than a doctor, according to a survey on the hospital's Psychiatric Assessment Unit (PAU) program, in a report by Ann Dooley in Computerworld (2-28-77).

The program was designed to let psychiatric patients giver personal information privately, including basic demographic data, chief complaint and history of mental illness, according to Dr. Ronald Giannetti, a project researcher and psychiatric instructor at the University of Utah.

Designed to aid clinical decision-making, the program has proved a faster and more efficient method of getting psychiatric patients into treatment, Giannetti said. The workload has dropped dramatically and the cost for each patient evaluation has been cut in half, he added.

The program has also led to increased patient satisfaction; 68% of the patient surveyed indicated they liked the computer testing and only 12% said they disliked it, Giannetti noted.

Although 21% of the patients found computer testing "too impersonal," 78% did not find this to be true, he said.

The survey also found 89% favored computerized testing, 57% liked it better than clinical interviews, 24% favored the clinical interviews and 17% had no preference.

Nearly half the patients said they tended to be "more truthful" with the computer and a comparable number said they were "as truthful."

RATES SEVERITY OF PROBLEM

Based on a patient's answers to test questions displayed on a CRT, the PAU system measures depression level and suicide risk, social history and a broad range of personality traits; it also screens intelligence level and the amount of any brain damage, Giannetti said.

The patient's test scores are interpreted and the results are output in English to a medical aid. Patients are additionally interviewed by a staff member who evaluates the test results and makes all treatment decisions.

The system consists of a Control Data Corp. 3200 system with 131,000-character memory and 13 on-line terminals. It has direct access storage for patient data on four disk units with a total storage capacity of 32.8M characters. □

HOSPITAL MANAGEMENT SYSTEM MONITORS PERSONNEL

According to an article in Computerworld, most workers don't like having the time and effort they spend on the job monitored. Nonetheless, more than half the hospitals in Oregon are successfully using a computer-based management engineering tool to increase the effectiveness of their personnel.

Sponsored by the Oregon Association of Hospitals, the Productivity Managment System (PMS) is characterized by Roland S. Hanson, the association's senior systems engineer, as a closed-loop control system.

"It provides for establishement of departmental labor productivity objectives, a plan to achieve the goals and a continual comparison of performance vs. goals," he said. However, it also includes the means for taking any necessary corrective action and the establishment of subsequent goals, he added.

The system can be used by both large and small hospitals. Since many of these institutions have neither the staff nor the inclincation to run in-house DP operations, PMS has been built on the programming and processing facilities of the Tymshare, Inc. network based in California, the engineer said.

The association's first PMS was installed two years ago by Hanson and program director Ron Ellingson.

Hanson's prior computer knowledge was minimal; his programming knowledge, nil. However, he "easily learned" to program a hospital's system using Tymshare's Information Management Library (IML) and is now re-writing it using the network's Magnum data base facilities.

A couple of the largest hosptials have their own terminals and individual accounts with the network. The association has a terminal on which it runs work for mid-sized hospitals, but even that is too expensive for the smallest units and they apply the PMS concepts manually, Hanson said.

GOALS ESTABLISHED

Installation of PMS is quite simple, according to Hanson. It starts with a gathering of work load statistics by department for the previous year. The average number of staff hours expended per patient day in that prior period then becomes the unit of measure or goal for the department for the current year.

(Although hours expended is the common measure for most departments, Hanson interjected, other units are used when they seem more logical. Number of surgeries or hours of surgery are the units for operating rooms; "procedures" are used for nuclear medicine, EKG and radiology; meals served for dietary departments.)

In general, then, the only inputs needed after the set-up of the system are hours worked by each employee and the work load for each department by month.

A key report of the system is a monthly departmental analysis of productive staff hours vx. target or goal hours. This report also shows the dollar savings or added cost, by month and year-to-date, as the current year's figures vary from the target.

As an example, Hanson cited a nursery that had expended an average of 4.47 hours per patient day last year, but by July of the current year had brought that figure down to 3.83 hours of 0.64 fewer hours per day than the target. Multiplied by the 355 patient days that month and the department's labor rate of $5.41, the nursery showed a savings of $1,220 for July.

EXCEPTION REVIEWED

As long as productive hours are less than goal, i.e., a production gain, no corrective action is required. If, however, average hours expended are higher than goal, a simple exception report is required. On it the department head identifies the primary cause of the productivity discrepancy and his plan to improve during the subsequent month.

Another report consolidates monthly totals and offers administrators a department-by-department review of productive hours vs. target hours.

Still another summary report compares dollar loss or gain performances from one year to the next for each department.

The purpose of the system is not simply to conserve labor. The program is viewed by the Oregon association as a means of more efficiently utilizing technical, administrative and support personnel. It further serves as a means of rationally projecting manpower needs and budgetary requirements for various levels of hospital activity. ■

PATIENTS MATCHED TO NURSING HOMES ON-LINE

A lot of the difficulty in matching the right nursing home and the right patient in a large metropolitan area has been diminished through the use of an on-line system in Los Angeles.

The county government has instituted the first on-line automated Nursing Home Information and Referral Service (NHIRS) in the nation.

Based on an IBM 370/158, the system provides information on approximately 460 facilities licensed as skilled nursing or intermediate-care facilities. The information provided includes, but is not limited to, the medical services and programs offered, history of licensing violations and corrections, type of patients accepted, special diets provided, languages spoken, personal services provided, desired location and the costs.

The data is displayed on three CRTs at the NHIRS headquarters and one at the Public Administrator/Guardian.

Special functions the system provides include an improved service level, rotation of facility referrals, "Do Not Refer" processing and area searching.

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To use the system, a consumer telephones the NHIRS office where trained operators question the caller to determine the requirements and needs of the patient. The various factors are displayed on a CRT and, using a light pen, the operator selects those requirements indicated by the caller.

Once the needs are checked off, the information is transmitted to the system.

The system then selects up to three nursing homes meeting all the specified requirements displayed on the screen. If a printed facility profile is desired, it can be produced and mailed to the caller. The service is free.

NHIRS was developed using local county funding of $145,818. The 370/158 was already operating in-house at the county DP facility. Annual operating costs are approximately $60,000/year, according to an article in Computerworld (2-28-77).

DATAPRO REPORT RELEASED ON LOW-COST SYSTEMS

SMALL BUSINESS COMPUTER SPECIFICATIONS

Datapro Research Corporation has prepared a new report providing detailed specifications of 228 low-cost computer systems and analyzes users' experience with more than 1,700 installed systems.

While this report does not include a review of any application programs it can provide a concise overview of the hardware and software characteristics of nearly all of the small business computers that are currently being marketed in the United States.

The report "Small Business Computer Specifications" is available for $12.00 from Datapro Research Corporation, 1805 Underwood Blvd., Delran, N.J. 08075.

BILL-VERIFICATION SYSTEM REDUCES COMPLAINTS

REVIEW BY CPU ENSURES PATIENTS NOT OVERCHARGED

The staff at St. Luke's Hospital in Kansas City, Mo., makes sure their hospital bills are in the best of health using a computerized bill-verification system, reported in Computerworld.

A typical hospital loses 10% to 15% in medical charges annually.

The key to the verification program is the patient's medical record which indicates all services performed.

egistered nurses in the business office review each atient's record and divide it into different billable services. These services are coded, keypunched and then processed on an IBM 370/145.

A master list of billable services and supplies needed for each medical procedure is stored in the CPU, which generates all charges associated with each procedure.

The system compares a patient's bill with the master list of charges to make sure the two totals correspond. Errors and omissions are reviewed by the hospital business staff before the final bill is processed.

"As a result of the system, more than $1 million in adjustments to patient bills have been made since the computer review system begain in 1974, "according to Charles C. Lindstrom, executive vice-president of the hospital.

REAL-TIME ANGIOGRAPHY DEVELOPED AT NIH

MINI TAKES PICTURE OF HEART WHILE PATIENT EXERCISES

Scientists in Washington, D.C., have developed a method of taking computer-constructed pictures of the heart while a patient exercises, according to Computerworld (2-14-77).

In traditional angiography, either a contrast dye is put into the heart through a tube and X-ray pictures are taken or a radioactive isotope is used instead of dye and images are made from the radioactive emissions.

The computerized method requires that a protein containing a small amount of a short-lived radioactive isotope be injected into almost any vein of the patient, the scientists explained.

Within minutes, an instrument that measures radioactivity is attached to the left side of the patient's chest that picks up the passage of the isotope through the heart and feeds its readings to a minicomputer system.

Michael V. Green, a physicist with NIH's clinical center and one of the three men who developed the method, said the computer system registers each point of radioactivity in the heart every 10 thousandth of a second and builds a three-dimensional picture that appears on a display screen.

The display projects a "movie" of the heart when these separate pictures are played one after another, according to Dr. Jeffrey S. Borer, a senior cardiology scientist at the National Heart, Lung and Blood Institute.

Dr. Stephen L. Bacharach, also with NIH's clinical center, worked with Green and Borer to create this form of angiography. Bacharach is responsible for programming the real-time system that constructs movies during data acquisition.

However, the new method doesn't measure pressures in the heart.

His team uses a Hewlett-Packard (HP) 5407 scintigraphic data analyzer for nuclear medicine. This system is composed of an HP 2100 mini, a nuclear medical display, a teletype-writer and magnetic tape drives.

The report appeared in Computerworld (2-14-77).

CYBER-MEETINGS

June 13-15, 1977: SIAM in Philadelphia. Contact: SIAM Meeting, 33 South 17th St., Philadelphia, PA 19103.

July 28-29, 1977 : ACM PACIFIC REGIONAL CONFERENCE in San Jose, CA. Contact: Peter Azego, Ampex Corporation, 401 Broadway, Redwood City, CA 94063; 415-367-3126.

September 6-9, 1977: COMPCON (IEEE) in Washington. Contact: Paul Skartvedt, TRW Energy Systems Planning Division, Bldg. W1, Room 3426, 7600 Colshire Drive, McLean, VA 22101; 703-893-2000, X2327.

September 26-October 1, 1977: AMERICAN SOCIETY FOR INFORMATION SCIENCE in Chicago. Contact: ASIS, 1155 Sixteenth St., NW, Washington, DC 20036.

October 6-8, 1977: THIRD INTERNATIONAL CONFERENCE ON VERY LARGE DATA BASES in Tokyo. Contact: Stuart Madnick, Sloan School of Management, M.I.T., 50 Memorial Dr., Cambridge, MA 02139; 617-253-6671.

October 10-14, 1977: INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY (IEEE) in Ithaca, NY. Contact: Terrance Fine, School of Electrical Engineering, Phillips Hall, Cornell University, Ithaca, NY 14853.

A Conference on Pattern Recognition and Image Processing will be held on June 6-8, 1977 in Troy, N.Y. For further information contact: Herbert Freeman, Department of Electrical and Systems Engineering. Rensselaer Polytechnic Institute, Troy, NY 12181.

The 1977 National Computer Conference will be held on June 13-16, 1977 in Dallas, Texas sponsored by AFIPS with ACM, DPMA, IEEE-CS and SCS. For further information contact: Stephen Levine, Lawrence Livermore Laboratory, P.O. Box 808, Livermore, CA 94550.

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DENTAL INFORMATION PROCESSING NEWSLETTER

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DENTAL INFORMATION PROCESSING NEWSLETTER

Volume 6, Number 3
Fall 1978

Short-haul Modems Save $

North Carolina Memorial Hospital, a 650-bed teaching center in Chapel Hill, has experienced improved communications between users and the computer system since adding a series of synchronous short-haul modems designed especially for short-distance, private-line data transmission.

The hospital, whose occupancy rate averages better than 90%, has more than 450,000 patient records in its master file. In addition, there are many other applications utilizing the data processing resources, such as purchasing and inventory, admission and discharge, appointments, bed status, accounts payable, accounts receivable, and patient billing.

Access to this data is provided through 76 terminals located throughout the hospital. Linkage to the Honeywell 6660 computer is by hard-wired voice frequency channels. Most of the terminals are located less than 1,000 feet from the main computer. The binary data is converted into analog voice communications before it is transmitted.

Previously, Bell 210C modems were used but this represented an under-utilization of equipment which had to be paid for nevertheless. The Bell equipment is highly suitable for high-speed, long-haul applications but is not cost-effective in this environment. Therefore, the short-haul Synchronous Line Drivers, made by the Prentice Corporation have been used to replace the Bell equipment.

A 10% spares level is maintained but the reliability of the Prentice equipment has been very good and the spares level has never been approached.

The Prentice equipment has paid for itself in approximately 9 months in comparison to the rental of the previous eqipment.

Thomas Galleo is director of management systems and data processing at the hospital. ■

Horror Stories Told at Hearings

The House Committee on Government and Individual Rights has been conducting hearings on legislative proposals to protect medical record privacy. Many horror stories were recounted in which the invasion of medical information privacy contributed to ruined careers, broken marriages, and damage to mental health.

Massive data systems are operated by insurance companies and government agencies. These systems can link data and are doing so. Disclosure of information in these data systems has the potential of being damaging or embarrassing. Frequently patients are not aware that such systems exist.

Some patients, knowing of the existence of such data banks refuse to seek needed medical treatment, apparently believing that disclosure of the information is potentially more damaging than the illness itself.

The Subcommittee is attempting to solve the problem through legislation. Experts point out however that there appears to be no absolute safeguard against unlawful access to computer-stored information, according to Jane Rogers, director of legislative affairs for the American Medical Association. ■

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Northwestern University
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University of Texas Health Science Center at Houston
University of North Carolina at Chapel Hill Dental Data Center

Murphy's Law Again

In the last issue, it was reported that Dr. Mortimer Shakun would be the new editor of CYBERDENT, beginning with this issue. He was to replace Dr. Clifton E. Crandell who was taking a sabbatical.

Immediately after this announcement Murphy's Law, "if something can go wrong, it will", made several iterations and prevented Dr. Shakun from assumming this reponsibility.

So, the old editor is back. Publication should be back on schedule shortly. Appreciation is expressed to readers, subscribers, and sponsors during this stressful period. ■

Computers Overpay

Overpayments amounting to nearly $5 million were mailed to about 1800 physicians in Florida's Dade and Monroe Counties recently. The error was caused by a mistake made by the computer operator. The physicians, who usually complain about the slowness of payment of Medicare claims, were paid twice during one payment cycle, apparently because the computer program was run a second time. Group Health Incorporated, the Medicare carrier for the area, sent Mailgrams to the physicians explaining the error. ■

On-line Costs Less

Studies show that as much as 30% of the cost of running a hospital is related to information processing and that expanded computer services could reduce total expenditures by as much as 8%, according to Roger Winner, information systems manager at the Allentown and Sacred Heart Computer Center, a nonprofit operation that serves four hospitals. This is reported in an article by J. Woodruff in COMPUTERWORLD (April 16, 1979.)

Winner says that the way medical records are structured has not changed for the past several hundred years. Information usually put on paper could be put on-line on the computer system at less cost. Costs of operating hospitals is increasing faster than the rate of inflation. The computer center in Allentown is trying to reduce costs by putting as much information as possible on-line. The center has an IBM 360/50 and an IBM 360/65, each with 512k bytes of memory. The system is heavily overlayed and saturated and an IBM 3031 was ordered but this order was canceled when the 4300 systems were announced.

A data dictionary was installed about a year ago. This makes it much simplier for a doctor to obtain needed information and also enables making changes in the center's 1200 programs in about 10% of the time previously required.

The center employs 45 people, 18 of them in systems development. The center operates 24 hours day and supports 40 terminals in the 4 hospitals. ■

Diagnostic Errors

Alleged diagnostic errors account for nearly 1/4 of medical malpractice claims against physicians, according to a report released by the St. Paul Fire and Marine Insurance Company.

Diagnostic errors made up 24.9% of claims incurred by St. Paul from 1973-1978, as compared to 14% reported by the 1970 survey of the Commission on Medical Malpractice, a gain of 10.9%.

There were 623 claims which alleged failure to diagnose cancer, representing 3.2% of the total. There were 867 claims alleging failure to diagnose fractures or dislocations, 4.5% of the total.

Failure to obtain adequate informed consent accounted for 2.5% and patient abandonment accounted for 0.8%. ■

Computer Evaluates Bitemarks

At a recent meeting of the Odontology Section of the American Academy of Forensic Sciences in Atlanta, Dr. Raymond D. Rawson, a dentist in the department of anthropology at the University of Nevada, Las Vegas, reported on a pilot research project in which he plans to enter more than 1,000 bitemark registrations into a computer in an effort to find a normal arch form from which the probabilities of deviation can be calculated for any specific arch or bite imprint. The information might be helpful for forensic dentists testifying in court as expert witnesses.

The bitemarks are input into the computer by making imprints in wax for the six anterior teeth of each arch. After radiopaque zinc dust is vibrated into the impressions, a radiograph is made and projected onto graph paper. An x axis is drawn between the distal surfaces of the cuspids and the y axis is a perpendicular line at the median plane.

Dr. Rawson has already entered 176 registrations into the computer. In addition to finding the normal arch form, the project also seeks to make correlations between arch forms and variables such as race, sex, and height.

In some courts, bitemark evidence is accepted in a manner similar to fingerprint evidence. The potential of bitemark evidence in criminal investigations is now being recognized as one of the research frontiers in forensic odontology.

About 50 dentists attended the two-day session. In addition to Dr. Rawson's presentation, there were lectures on the use of orthodontic records, age changes in the make-up of dentin, the marking of removable dentures, and the planning of the dentist's role in forensic investigations.

Dr. Robert Siegel and Dr. Norman Sperber of San Diego described their work in identifying the 144 people killed in an airplane crash there in September. Their computer program matched antemortem and postmortem evidence to aid in the identification of the victims.

Dr. Edward Herschaft and Dr. Robert Rassmussen of Louisiana State University presented a model curriculum for forensic dentistry and Dr. James Woodward or Oral Roberts University urges the establishment of such a curriculum in dental schools. ■

Overtime and Error Problems Treated

Implementing a disk data entry system enabled Brockton Hospital to expand its data processing services without increasing costs, according to an article in COMPUTERWORLD (April 23, 1979).

Overtime salaries were exceeding $300 a month and rising. Verification was sometimes eliminated and department complaints about data-entry errors were increasing. Funds were not available for staff increases to meet the increased demand.

The advantages of programmable key-to-disk equipment and lower costs have been established in the literature. After investigating several possibilities a key-to-disk system was installed with a CPU and 4 CRT stations. After 4 months the data entry operators had accepted the new system and did not wish to return to punch-card input. Productivity dropped initially but recovered in 3 months and after 6 months had increased by 25%.

The editing features of the system allows immediate correction of operator errors during the first pass of the source document. System prompts have also proved invaluable. For example, typing in the zip code automatically fills in the city and state, significantly reducing the keystrokes necessary for input and verification, as well as the error rate.

Stephen L. Priest is the director of the Massachusetts Hospital Information Systems Division and Robert L. Sheehan is the assistant director. ■

Relief From Paperwork

When the Medicaid agency for the state of Maryland added a new report form recently, it was one too many. As a result, 34 members of the Maryland State Hospital Association filed suit seeking relief from this additional regulatory requirement. It seems that there are 108 agencies which demand reports from the hospitals costing more than $19 million per year.

Charles Putnam of the Maryland Medical Assistance Policy Administration says the new form is needed to screen claim denials before bills are paid in cases of abuse, but Steven Summer of the Hospital Association says the report duplicates information on other reports.

It is estimated that the new form will cost the hospitals an additional $1.3 million per year. ■

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CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

Volume 6, Number 4
Winter 1978

Birth Defects Information System

A Birth Defects Information System has been set up on an IBM 370/168 computer at Massachusetts Institute of Technology in Cambridge, according to an article by Mary Kincaid in American Medical News. Institutions in 21 American cities have joined the system, enabling obstetricians, pediatricians, and geneticists to obtain the most recent updates of information on birth defects.

In recent years many couples have been seeking genetic counseling and the number of malpractice suits involving birth defects is increasing.

A physician desiring to use the system might interact with the computer through a typewriter-like terminal on a dial-up basis. The printout includes clinical findings, minimal diagnostic criteria, ediology, risk of occurrence, risk of recurrence, and age of detectability. At the end of the printout references are given along with the name of the contributor.

Prior to establishing the information center, birth defect information was available from a large printed volume, "Birth Defects Atlas and Compendium". Despite frequent revisions, much of the data would be a year out of date on publication. The goal of the computer project was to make possible weekly updating.

The March of Dimes initiated the project and contributed $500,000 for beginning funding and continues to support the project. Institutional members are spread from coast to coast and in Hawaii. More institutions are joining each week.

Although the system is now merely an information system, it may in the future be developed into a diagnostic tool. ■

Dental Placement Network Set

A placement network for dentists, based on a computer system, has been announced by the American Dental Association. The ADA appropriated $593,453 to support the system during its 3-year startup period. The Kellogg Foundation added $579,605, making a total of $1,173,058. After the three year startup period, the system is expected to be self-supporting.

The National Health Professions Placement Network will match dentists and practice locations or employers. Employment opportunities can also be matched for dental auxiliaries. The system may be expanded later to include other health professionals. The system is expected to ease the geographic maldistribution of dental personnel as well as providing a convenience to members of the profession. It will be especially useful to new graduates and persons who are relocating.

Dr. David O. Born is director of the project. He originally developed a similar system for Minnesota. North Carolina and other states now have systems which emulate the Minnesota system. ■

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Editorial

HOW AM I DOING?

The management of a computer center is similar to the management of other enterprises in many ways. It has been observed recently that some of young, bold men and women that grew up with the computer are now old enough to be moving into senior management positions and indeed, a proportionate number are doing just that.

EDP managers have been admonished frequently to keep top management involved in computer decisions. It is supposed to be even more important that users be involved heavily and deeply in the development of new applications.

If interest in EDP by management and users is only peripheral, the work of the computer people is made much more difficult. The EDP manager must constantly find ways to get pats on the back for his analysts and programmers from persons outside the shop. Even worse, problems with systems that arise from careless and improper operation by users and production groups seem to be more often blamed on the developers. It's a simple fact that those who go first are subject to criticism of all that follow. So, what else is new?

What's new is that the EDP managers who have been promoted to top management should be particularly sensitive to problems of involving senior executives in EDP decisions and involving end-users in the system development process. What remains to be seen is whether this special group of new executives can do any better in this situation because of having seen the problem from both sides? How am I doing? ■

SAS.79 Released

SAS Institute has announced a new major release of the Statistical Analysis System (SAS). The new release includes support for structured programming and improved array processing. The updated system allows IF-THEN-ELSE structures to test conditions and run appropriate procedures. Also supported is a DO/END statement to make it clear when DO loop coding is finished.

The SAS library also includes basic capabilities such as tape copying and printing label information from standard label tapes. Bit-testing facilities are also available.

There is a summary routine which gives statistics for all possible subgroup combinations with just one pass of the data and without requiring any sorting. There are other routines which enhance the handling of univariate, multivariate, and time series analysis.

SAS.79 runs in batch mode or under IBM's TSO. Further information can be obtained from the SAS Institute, P O Box 10066, 2806 Hillsborough Street, Raleigh, NC 27605. ■

Light Pens $142

The LP-700 low cost light pen has been introduced by Information Control Corporation. In quantities of 100 the unit will cost only $142 each.

The LP-700 is designed for use with CRT displays and will handle symbol sensing, editing functions, and CRT graphics. Solid-state electronics within the body of the light pen are featured in the new unit, which uses a single-voltage (+5V) power supply. Light and activation output signals are TTL-compatible, and optionally they are user selected levels.

The luminous sensitivity is 1.0ft.-L and is adjustable. The response time is 300nsec. It has a sharply defined acceptance area with standard sizes and an optional aperature for special applications, including a telescopic tip for large distances. Actuation is accomplished by a push tip or a side push button. Combinations are also available.

Further information is available from Information Control Corp., 9610 Ballenca Ave., Los Angeles, CA 90045. ■

Voice Input Unit

Dialog Systems, Inc. has announced the Model 1800 voice input terminal which reportedly allows users to input data and communicate with an attached computer via a standard telephone. The system then responds with spoken output.

The unit accommodates up to eight users at once. Applications where the terminal would be most useful include order entry, credit card verification, and inventory inquiries. The unit is especially recommended for traveling salesmen who cannot take specialized terminals with them. The unit is designed to solve the problem of the required Touch-Tone telephone or pads usually required for this type of application.

The least expensive unit is used for input only and can recognize 21 words, including 10 digits and command words. The response vocabulary consists of 128 words, expandable to 256.

The Model 1800 can interface to a standard RS-232 communications line, and can emulate standard computer interfaces as well as operating off-line magnetic storage media.

Prices begin at $60,000. More information can be obtained from Dialog Systems, Inc., 32 Locust St., Belmont, Mass. 02178. ■

Winning Combination

A major effort aimed at reducing the time and expense to test new combinations of cancer treatment drugs has been initiated at the cancer center of the Medical College of Virginia through support of a $112,000 grant awarded by the National Cancer Institute.

Over the next three years a technique widely used for bolstering industrial efficiency will be adapted by researchers to the testing of chemotherapeutic drugs in various schedules of dosing and in multiple combinations with other drugs. In order to determine the best combination of drugs for treatment, a computer designs and prints out a multidimensional graph with density as well as heights and depth. To the computer, the results are constructed like a hard-boiled egg, with the center represented the optimum conditions and the shell representing the worst conditions.

According to Dr. Galen L. Wampler, the principal researcher in the project, new possibilities for chemotherapy offer thousands of variables that would require hundreds of years to test using conventional statistical standards. However, the response surface methodology technique predicts trends after fewer experiments and enables researchers to evaluate several variables simultaneously. ■

Accurate Bio-data

At the National Computer Conference in New York recently, Dr. Edward C. Deland, called for more accurate data and better data management. Deland is professor of biomathematics at the University of California, Los Angeles, Medical Center.

"Biological data is unlike any other kind of data because it is typically gathered with the least concern for constant control, and therefore it is bad data," according to Deland. He reported on his use of the computer to simulate the basic chemical reactions which take place at the capillary level, aimed at the problem of maintaining life in heart tissue during surgery. ■

Turnkey System

Professional Accounting Machines, Inc. (PAM) has introduced a turnkey data management system with bundled software for dentists priced at $17,900. The price includes all hardware, software, customized forms, methods and procedures as well as training in the doctor's office.

The desktop system is call Medac 310 and consists of a central processing unit for either batch or interactive use, a keyboard, and a CRT in one console. A printer and a dual disk drive storage module is attached.

Outputs include billing, claims, aging of accounts, financial summaries, appointment lists, and bank deposit slips. The programs are flexible to permit local customization.

Service is available nationwide through the 52 Cal-Comp service centers.

More information is available from the company at 1630 S. Lyon St., Santa Ana, CA 92705. ■

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Volume 7, Number 1
Spring 1979

Automation Advanced at Nijmegen

In the early 70's the School of Dentistry at the Katholieke University of Nijmegen in the Netherlands conducted a curriculum study and the decision was made to make substantial changes in the program, aiming toward the concept of comprehensive care. At the same time it was decided that many of the administrative functions of the school could be better performed by automated techniques. The study included visits to other schools, including several in the United States, which were planning or implementing similar systems. Matthè van Groningen, chief administrator of the school, and Professor A.J.M. Plasschaert, head of the department of operative dentistry and endodontics, visited several sites.

Also under consideration were proprietary products from computer manufacturers. Although these products were designed for use in hospitals, several features offered were desired for the dental school system, including Hospital Care Support System, Patient Scheduling System, Patient Appointment System, Patient Registration, Admissions System, and Order Communications System. Most of the proprietary products were designed to operate in an on-line mode. Because one system could not be found which provided all of the desired features, it was decided to implement several systems and to develop an interface between them.

For patient registration, billing, and general administrative functions, the Hospital Care Support System was installed on an on-line mode. Terminals with keyboards and visual displays were installed in the Polikliniek and in Cental Patient Administration. In addition, a printer was installed in Central Patient Administration to print patient labels which would later be affixed to other input documents.

To monitor the progress of students and patients through the system of comprehensive care, the Student Scheduling System for the University of North Carolina was installed. Disk format had to be changed and PL/I compiler differences had to be resolved. Plasschaert designed input forms and translated the ADA procedure code and the Users Manual from English into Dutch. Later the outputs were translated. Ing. Henny W. Poort was responsible for the computer program installation, aided by Mr. Eric Plow of UNC. The initial implementation involved only the department of operative dentistry. The procedures were used in the intergrated clinic however, which involved treatment in all phases of dentistry. At Nijmegen the system is known as ASKO (Administratie Systeem Klinisch Onderwijs).

A significant difference in the SSS system at UNC and the ASKO system at Nijmegen is the method of input. At UNC cards are filled out for each patient encounter. These cards are then keypunched. At Nijmegen, cards are marked and read by an optical mark reader, bypassing the keypunching function and reducing turnaround and errors.

The matching of patients to students is a part of SSS at UNC but was not implemented at Nijmegen in the beginning. Efforts toward this were begun in the fall of 1978 when Dr. C. E. Crandell of UNC became a visiting professor at Nijmegen. He designed forms, formulated procedures, and implemented the screening process. In 1979 the screening form was revised to enable recording of information for all departments in the school.

In addition to the systems for patient administration and student monitoring, Nijmegen also has a system for test scoring and analysis. Self-paced instruction is widely used at Nijmegen and the test scoring system provides immediate feedback and remedial material for students.

Another system, Dental Management Game, is operational but is not yet available to users. This program was originally developed at Case Western Reserve but transferred to Nijmegen from UNC. Dental Management Game is an interactive system which permits the dentist or student to experiment with changes in staffing, hours, fees, and other variables to determine the effect of changes before implementation in a practice. ■

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Editorial

WORD PROCESSING, TEXT EDITING, OFFICE AUTOMATION

Progress in recording ideas may be ready to make a great leap forward. In pre-historic times, it was difficult for man to accumulate information except through conscious memory which largely died with the owner. Language was poorly developed verbally and non-existent otherwise. Genetic memory was passed from one generation to another at the subconscious level.

As language developed, the urge to record it became stronger and caves were marked with charcoal, stones were chiseled, and symbols were carved.

By comparison, the invention of paper and the printing press have been rather recent. Over the last few centuries, there have been steady and significant improvements in printing. Different languages have held sway for brief periods under a variety of influences. French was a very popular language a century ago and achieved a prominent position in world literature and affairs. It is still the official language of many international bodies. But English now predominates. Because it is more efficient.

The computer provides fast printing and can do editing, spelling-checks, right-justification, and other fancy things. Memory typewriters and word processing systems do most of the same things and make it pretty at the same time. And even the Post Office is considering Electronic Mail. Do away with the paper - go electronic!

But technology is ahead of our development of personal relations in the office. Will the new executive bypass the secretary? ■

Micros for Medics

The benefits for the microcomputer as a teaching aid especially for beginning medical students was described by Dr. James E. Randall of Indiana University at the recent National Computer Conference in New York. Randall said the microcomputer gives students the opportunity to interact with mathematical simulations which gives them the feel for an idea much more rapidly than the analytical process. ■

Micro Sales Up

A survey in Physicians Microcomputer Report indicates that more than $8,400,000 worth of microcomputer equipment and small business systems equipment was purchased last year by medical practitioners.

Radio Shack's TRS-80 captured 20.1% of the market. Mits Altair (Pertec) was listed at 10.2% and Digital Equipment Corporation's PDP-11/03 was responsible for 9.8% of the market. This was for the first six months of 1978; in the last six months of 1978 however, Radio Shack had 46.3% of the market. Apple moved into second place.

Purchases are expected to increase by 400% in 1979. Radio Shack's share is expected to increase to 58-65 percent, and Apple increasing to between 14 and 18 percent. A 300% increase is expected to occur in 1980. ■

Scanner Identifies

A new technique for locating abnormalities in cervical cells has been shown to be highly accurate by Dr. Seymour S. West at the University of Alabama. The new technique utilizes a computerized scanner to screen the cervial cells. It allows the classification of cells by measuring the intensity of green fluorescence in the nuclei stained with acridine orange. West says that the amount of fluorescence is related to the nucleic acid in the nucleus; tumor cells usually contain more DNA than others.

In any abnormal slide, one or more malignant cells will exceed a certain intensity of fluorenscence, causing a buzzer to sound, summoning a cytology expert and recording the precise location of the abnormal cells. ■

Test Repeated after Computer Failure

An error in a computer program which scores examinations was responsible for more than half of the senior class at the University of Michigan School of Dentistry to re-take a final examination. When a student skipped a question, the computer program failed to add these questions into the final score. The program allows students to temporarily bypass difficult questions. The bypassed questions should have been added on to the end of ~~the~~ test, but the program failed to add the questions and based the students scores only on the answers given. Some students answered almost all the questions and thought they had completed the test, but others answered fewer questions and obviously tried to beat the system. Dr. Robert Doerr, associate dean, said the school might have dealt with the situation more severely but they had no accurate way of determining who cheated and who didn't. Not wishing to penalize anyone unfairly, 77 of the 139 members of the class were permitted to take the examination a second time. The examination was given to the students using computer terminals.

The incidents attracted considerable interest, with stories appearing in a Detroit newspaper and also in the New York Times. ■

Computer Grants

Early in 1979, eight quality assurance research projects were funded by the Kellogg Foundation. These projects will be administered by the National Dental Quality Advisory Committee of the American Fund for Dental Health.

One of the projects is titled "Computer Applications for Peer Review and Quality Assurance in Dental Care." This project was sponsored by the California Foundation for Dental Health directed by Daniel F. Gordon. The project was funded to determine the feasibility of using computer technology as a first-level screening mechanism for quality assurance and dental care.

Specifically, the objectives were to develop applicable parameters, implementation procedures, and computer methodology. ■

Graphics Newsletter

A biweekly newsletter on important commercial, technological and product developments in the computer graphics field is now being published by the Harvard University Laboratory for Computer Graphics.

The publication will be known as the "Harver Newsletter on Computer Graphics" and will be directed toward users and vendors and will focus on research, development, and usage.

Standard computer graphics applications will be included in the publication. Also there will be articles on statistical graphics, management, design, engineering, manufacturing, and image processing.

A one-year subscription costs $125, but a nine-issue trial subscription is available at $45. Further information can be obtained by writing to the Laboratory for Computer Graphics, 520 Gund Hall, Cambridge, Mass. 02138. ■

Simulating Space

Dr. Joel Leonard of the National Aeronautics Space Administration in Houston recently described using simulation techniques for research in space travel at the recent National Computer Conference in New York. The research is aimed at studying physical responses to zero gravity and health problems such as calcium loss and motion sickness.

Actual flight data have been used to establish an automated data base and a software system has been developed to analyze the data. The research team is made up of biosystems analysts and physicians. The researchers try to predict how the body will react to certain conditions encountered in space. From these formulations a simulation model is developed to compare to experimental responses. ■

Simulating Kidneys

A technical description of his computer simulations of mammalian kidneys was given by Dr. John L. Stephenson of the National Institute of Health in Bethesda at the recent National Computer Conference in New York.

"The sophistication of simulation models is beginning to approach the complexity of the kidney itself," said Stephenson. He reported he is able to change the ratio of short and long nephrons. ■

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DENTAL INFORMATION PROCESSING NEWSLETTER

Volume 7, Number 2
Summer 1979

ADA to Feature Computers Impact

The impact of computers will be the subject of an all-day seminar in Dallas on October 23, according to an announcement by the American Dental Association.

The "Role of Computers in Dental Office Management" will be the subject of an essay by Dr. Gerald Dietz, an endodontist from Birmingham, Michigan. Dr. Dietz is said to have also had a keen interest in the business side of dentistry and is an articulate and exciting speaker. He is the senior member of a large computerized practice consisting of seven endodontists and sixteen operatories.

In addition, he heads Professional Growth Advisory, a consulting firm, which has led to his investigation and systems development of information processing techniques that reach into every facet of dental practice.

The half-day lecture will compare cost, means of programming, and management application involving the use of computers in dental practice.

"The Role of Computers in Research and Patient Care" will be the subject of a second half-day lecture to be given by Dr. Sheldon Baumrind, a leading researcher in knowledge storage and retrieval. Baumrind is an orthodontist from Berkeley, California.

Baumrind used computers first in his masters thesis preparation. Later he investigated the use of computers for assessing the effectiveness of orthodontic treatment.

His lecture will include a projection of uses of the computer and other technology in dentistry over the next ten years. He forsees assistance in diagnosing pain, recording and analyzing patient records, controlling patient flow, conducting continuing education courses in the dental office, searching the literature, and developing analytical patterns of patient care. ■

FDI Schedules Symposium on Computers

A symposium, "Computers in Dentistry" will be a feature presentation at the 67th Annual World Dental Congress of the Federation Dentaire Internationale to be held at the Palais des Congress of the Centre International de Paris, October 22, 1979. Four speakers have been selected to present different aspects based on their experience in the use of computers in dentistry.

Dr. Clifton E. Crandell will lead off the symposium with a discussion of "Using Computers in Dental Office Management". The presentation will include a review of the literature, the development of a hypothetical system for dental offices, planning a computer system, and a discussion of current and future applications of computer technology in the dental office. Dr. Crandell is director of the Dental Data Center, School of Dentistry, University of North Carolina, Chapel Hill, NC, and has been involved in the use of computers since 1959.

The second presentation will be concerned with

(see FDI SYMPOSIUM on page 2)

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From the Editor

PRIVACY OR SECURITY OR BOTH?

There are not many problems faced by the computer professional that are as complex or come as near to defying solution as privacy and security. The passage of the Privacy Act of 1974, followed later by the Freedom of Information Act, has intensified a problem into a crisis.

Management sees the new requirements as an addition to an already sky-rocketing increase in data processing costs. The new procedures cost money to implement, reduce efficiency of computer operations, and limit access to data that might be useful.

Public awareness of invasions of privacy is at a high level. Patients whose medical and dental history contains information that is potentially damaging are simply not telling the whole story for fear of its indiscreet or inadvertent disclosure. A recent poll indicated that 54 percent of those interviewed believe that the present use of computers is a threat to privacy and two-thirds are of the opinion that computerized data is not protected adequately.

Still, the new legislation, on balance, seems to be fair. Shouldn't collected data be kept safe, secure, reliable, and secret? Shouldn't a person have access to data about themselves and be able to correct it if there are errors? Shouldn't a person be able to give their address and phone number without receiving tons of unsolicited and unwanted mail? But there is a price to pay for this which will ultimately be passed on to the consumer. Are you ready to pay?

(more FDI SYMPOSIUM from page 1)

"Computers in Preventive Dentistry", to be given by T. M. Marthaler, A. Bandi, and M. Steiner. They will report on their use of the computer at the Zahnarztliches Institute in Zurich.

"Computer Applications in Orthodontics" will be the third presentation, to be given by Dr. R. F. Sloan. Dr. Sloan is well known for his many applications of automated technology in the field of orthodontics. He is from Escondidio, California.

The fourth speaker, Dr. I. Kramer, will discuss "Computers in Clinical and Laboratory Diagnosis". Dr. Kramer is from the Eastman Dental Hospital in London and will share his experiences at that institution.

Simultaneous interpretation will be provided in English, French, German, Japanese, and Spanish. The scientific reports presented at the Congress will be published in the International Dental Journal. This outstanding program has been arranged by Dr. Robert Frank of Strasbourg. Further information may be obtained from Dr. Alain Deyrolle, Secretary General of the Congress, Association Dentaire Francaise, 19 Bis, Rue Legendre, 75017 Paris (France).

Privacy Publication

In recent years, the invasion of privacy has been a popular topic in the news. Now there is a monthly newsletter and an annual publication devoted entirely to this subject.

"Privacy Journal" is a monthly newsletter which deals with the legislation events and sources of information about the application in automation. It is published by Robert Ellis Smith, a lawyer and journalist. Annual subscription fee is $49.

Smith also publishes an annual "Compilation of State and Federal Privacy Laws" for $14.50. Both publications may be ordered by addressing Smith at P. O. Box 8844, Washington, DC 20003.

AFIPS, American Federation of Information Processing Societies, Inc., publishes the "AFIPS Washington Report", which often includes privacy information, news, and comments. The organization also has a special committee on rights of privacy. Further information about the committee or the reports is available from AFIPS, 210 Summit Avenue, Montvale, New Jersey 07645.

Since health data is one of the most sensitive areas of concern in the privacy issue, dentists must stay informed about the basic principles involved.

WAMI Meeting Report

The Second Annual Meeting of the World Association for Medical Informatics was held in Versailles, France, March 19-22, 1979. The meeting was jointly sponsored by WAMI, the Parliamentary of the Assembly of the Council of Europe, and by SIRIUS, the National Pilot Project on Distributed Data Bases in France.

After the opening remarks, three survey papers were presented by Jacques Beer Gabel, French Ministry of Health and Social Security. "Survey of Medical Computing in Japan" was presented by Masao Saito, Institute of Medical Electronics in Tokyo. "Recent and Prospective Developments in MUMPS" was presented by Richard Walters, School of Medicine, University of California at Davis.

Walters said that although a standard MUMPS has been recognized by the American National Standards Institute since 1977, there are now 14 dialects. MUMPS is supported by the Digital Equipment Corporation in the USA, by the Phillips Company in Europe, and by five companies in Japan. It will run on the PDP-11, PDP-10, ECLIPSE, PRIME, Harris, and Copra in Brazil. UNIVAC is adapting it to their equipment, as is IBM and Motorola. Most of these applications are in the public domain. A new copy of the revised primer will be available soon.

Of the many applications of MUMPS, 40% are in the medical field and 60% are commercial. The Veterans' Administration in the United States has implemented MUMPS in several of its 170 hospitals. A hospital group in West Germany is in the process of switching to MUMPS. COSTAR, developed by Barnett at Massachusetts General Hospital, runs under MUMPS and is gaining in popularity. London Hospital has switched to MUMPS from COBOL. Walters concluded by indicating developments which are evolving for future use: 1) emphasis on distributed systems (via micros), 2) micro-code for MUMPS, 3) MUMPS for a micro machine, and 4) a sharing of MUMPS with other languages.

In the session on medical records, several speakers discussed their difficulties with using various coding systems. P. Frutiger of Geneva in his paper "The List of Problems, Its Updating, Archiving and Preparing for Discharge Summaries Using ICD/SNOMED Nomenclature", categorized medical records as being related to research, patient care, or patient management. The research data has a problem orientation, patient care information has patient orientation, and patient management data has a clinical orientation. He described a system of records in which ICD9 is used to delineate a category and this section of the record is mandatory; SNOMED is an optional part of the record and is used for a description and freetext is used for an explanation. Reasons for this arrangement is that ICD9 is quite general, SNOMED is more specific, and freetext can be quite specific. E. Florence and others of France use a similar scheme and delineate these types, classes, or levels of data with black, gray, and white backgrounds on the CRT.

M. Amphoux is a physician working in the area of occupational health in private industry in France. He indicated that his extremely large data base presented many update problems and an error rate that is close to a manual system. He also said the ICD code has to be expanded to allow for additional description.

M. S. Blois of the University of California at San Francisco in his paper "The Structure of Descriptive Information in Medicine" described his research with Whitehead's hierarchy of information levels. He reports that precision is less at higher levels and also incomplete, but he is developing a model which should solve some of these problems.

Colonel M. W. Hannegan, of the Armed Forces Institute of Pathology in Washington, described three years of work that a tri-service group has spent developing a data system. Thirty-five data items for each patient have been identified with fair agreement between the services. Coding for the system has not yet been started.

C. M. Plotz, in his "A Computer Data Base Designed for Primary Care in a Family Practice Center; Implications for Research", described a manual Problem Oriented Medical Records System that has been in use in a new clinic since 1971. Computer inputs are now being used for registration and encounters. The system used ICD code variations. The system outputs include quality control as well as the usual productions.

H. R. Oldfield, Jr., President of Medequip Corporation of Rockville, Maryland, discussed "World Trends in Automated Multiphasic Health Testing and Services". In describing his system, Oldfield emphasized that it can be used for information gathering and processing as well as for screening. For example, regisration can be accomplished by a clerk at a CRT and then the patient sits at the CRT for the medical history. There is an immediate printout before the principal examination and highlights or exceptions are noted to enable the physician to scan the entire medical history in less than five minutes. Appropriate patient education materials are selected by the computer. The system is said to increase accessability, reduce costs, and improve productivity in some cases as much as one-third.

Growth of such systems has been from 3 to 147 installations during the period of 1970 to 1977. Of these, 86 are in the United States, 59 in Japan, and 14 are in Europe. Outpatient clinics account for 33% of the installations, and hospitals account for 30%. Batch operation is used in 60% of the systems, about half as many are on-line and some are in real time.

Most such systems (35%) are sponsored by labor unions. The average cost per patient is about $75 which compares favorably to the $216 cost for similar manual systems. Of the $75, the computer costs are actually $6-$8. ■

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Volume 7, Number 3
Fall 1979

Remote Cardiology Service Effective

HEART EVALUATION BY TELEPHONE

Two important services for heart patients are available by telephone from St. Joseph Hospital Division of Cardiology at Creighton University in Omaha.

For example, a physician is a rural hospital in South Dakota can transmit a patient's electrocardiogram to St. Joseph for analysis. An IBM computer reads that data, then a cardiologist looks at the data, and the information is stored for reference and retrieval by the South Dakota physician within a few minutes.

COMPUTER MONITORS HEARTS REMOTELY

Another service that is available is the computer monitoring of the heart rhythms of cardiac care patients. For example, Community Memorial Hospital in Missouri Valley, Iowa, is connected by telephone lines to Creighton University heart monitoring system. Other hospitals in the area may join the system in late 1979, according to an article in MINICOMPUTER NEWS (June 7, 1979).

EXTENSION OF PREVIOUS SERVICE

The present service is an extension of similar services that have been available for a long time. For about 15 years, electrocardiograms have been sent to St. Joseph Hospital from 167 locations in 11 states of the midwest and Rocky Mountain area. The use of the computer to receive the ECGs, analyze them and store the information has been operational since 1974. Physicians now have access to millions of ECGs with which to make comparison.

MD OVER-READS COMPUTER ANALYSIS

Usually the computer analyzes the ECG and the cardiologist over-reads the results. The cardiologist then dictates a report which is sent to the remote location by mail or phone. The referring physician can discuss the result with the cardiologist by phone if he so desires. Each of the doctors in the cardiology division has a data phone in his home. They take turns reading ECGs on nights, weekends, and holidays. It is not unusual for a physician to study more than 60 ECGs in one evening.

PACEMAKER CHECKUPS BY PHONE

A special group of patients, those wearing pacemakers, are aided by another service offered by the hosptial. Pacemaker patients can receive a checkup at home by placing a small box on their chest and the telephone receiver on top of the box. The signals of the heart and pacemaker are thereby transmitted to St. Joseph for analysis. Periodic monitoring is necessary to assure the affectiveness of pacemakers and to detect developing problems. If a problem is detected, the physician is notified immediately.

CARDIAC PATIENTS MONITORED

There are 53 cardiac beds at St. Joseph and these patients have their heart rhythm monitored 24 hours a day. This is said to be the largest program of its kind in the United States. A light flashes on a monitor when the patient's heart has an abnormal beat. A technician verifys the abnormality and if the beat is a premature ventricular contraction, the computer counts subsequent abnormal beats and alerts the nursing stations. ■

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From the Editor

HOW MUCH INFORMATION IS ENOUGH?

One of the issues in current discussions about privacy legislation concerns the collection of too much information by physicians and dentists in building a data base on their patients. The concern on the part of the patient is that some of the information is not pertinent to any medical decision. Most dentists with more than a minimum of experience has heard the reply, "Why do you want or need to know that?"

Probably the usual reaction to such a reply is to explain but there is also the non-verbalized rationalization that the patient does not fully appreciate the broad scope of skills that the modern dentist possesses.

Such a flippant dismissal takes into account only a small part of the issue. Reluctance of patients to reveal the truth about themselves to doctors from an obviously different social class has been documented. Questionnaires and interviewers attempt to deal with this by asking the same question more than once but in different words. How many times does the question have to be answered to get at the truth? Will the psyche of the patient let them tell the truth?

Assuming that a valid answer is obtained, will the information influence decisions about treatment? Will it aid in the management of the patient? Will it enable the doctor to make the required reports to government agencies? Can it be recorded efficiently and accurately?

Those are the questions that must be asked about each item of information doctors collect. ■

Eliminates Errors

The monitoring, control and data logging functions for equipment sterilizers can be done with a real-time microcomputer system at 1/3 the cost of other instruments, according to an announcement by Scientific Industries, Inc.

The instrument is called Steritrol and assures faster, more accurate sterilization while eliminating errors by the operator of the sterilizer. Steritrol is said to be fail safe. The sterilizer operator interacts with a program in a question and answer dialogue by way of an on-line printer and a CRT terminal.

Calculations and printouts for recordkeeping are also provided, as well as heat distribution and validation studies. ■

Drug Interaction

Drug interaction that could nullify the effectiveness of medication on the one hand or synergistic effects that could threaten a patient's condition have been programmed into a microcomputer to help medical professionals in planning treatment.

The Pharmacy Dedicated Information System (PDI) has been introduced by the McGaw Laboratories division of American Hospital Supply Corporation. It utilizes a chip that contains information on over 500 drugs with a potential of over 50,000 individual interactions.

The system prints out all known interactions and also indicates the expected interaction. Further, it refers to a page in an accompanying manual where the operator can find the source and significance of the data as well as the generic and proprietary names and other drugs that could be substituted. ■

Book Review

DECISION ANALYSIS IN MEDICINE

This book, by Dr. Edward A. Patrick of Purdue University, applies statistical pattern recognition to medical procedures, beginning with a model of diagnosis and consulting. Implementation of optimum and ad hoc decision rules are presented. Combinations of treatment and diagnosis with respect to possible patient outcomes are evaluated. A new model is used to follow a patient's path as his condition changes. The expected outcome and cost-benefit ratios are also evaluated. Automated consulting and diagnosis systems are detailed. The book is published by CRC Press, Inc. and sells for $59.00. ■

Emergency Med-Phone Service

HOUSE CALLS BY TELEPHONE

A new twist has been added to the practice of making house calls by a staff of doctors using telephones and computers in New York.

Emergency Med-Phone is a medical consulting service which puts people in touch with qualified physicians during off-hours. Clients pay a small fee for the privilege of conferring with a staff doctor when their personal physician is not available. Service is explained by Tim Scannell in an article in COMPUTERWORLD (June 4, 1979).

Service utilizes the telephone to link the patient with the doctor according to Geral Shapiro, administrative director of the service, the success of the service depends on the accuracy and availability of each client's medical history. When a client contracts for the service, he completes a three-page medical questionnaire which covers everything from allergies to serious bodily disorders. This information is forwarded to a service bureau for data entry and indexing.

Then, when the patient needs medical advice, he calls the service. The staff doctor looks through the computer-generated patient record and prescribes appropriate treatment.

The medical history is updated about every week or ten days. In addition to keeping the medical history, the service records the phone calls, including physician's reports or medical notations that evolve from any telephone sessions. Billing, subscription renewals, and other administrative duties of the medical consultant is also provided as a part of the service.

The service now operates entirely in batch mode but as the number of subscribers increases, there are plans to switch to an on-line operation. The Emergency Med-Phone service seems like an innovative idea to many but actually it is an extension of referral services that have been available for many years. A similar service was offered as a part of health insurance in that insured patients could call the Emergency Medical System during off-hours and be referred to a particular doctor or treatment center. Experience with that system had indicated that about 70% of after-hours calls didn't required sending people to a doctor or a health facility. Studies have shown that about 2/3 of people who arrive at emergency rooms only needed advice and not treatment.

Emergency Med-Phone currently employs 21 physicians to answer the telephone. There are several nurses and medical administrators who record pertinent information and perform other tasks. In addition to giving medical advice, the staff can also make arrangements for hospital emergency rooms. locate an all-night pharmacy, or try to locate the regular physician. ■

Better Service at Less Cost

THROUGH-PUT IMPROVED BY A FACTOR OF SIX

A computer system has enabled the six-fold improvement in through-put, and increase in service to patients, and a reduction in paperwork for a pharmacy operation in Glendale, California, according to an article in COMPUTERWORLD (June 11, 1979).

Before the computer system was installed in 1972, the service employed 12 clerical workers and serviced 3500 patient beds in nursing centers in southern California. After the computer system was installed the number of clerks was reduced to 5 and the service extended to 9000 beds. There are three consulting and seven dispensing pharmacists associated with the service.

In addition, it became much easier to maintain patient drug profile, monitor drug interactions and allergies, keep abreast of medicaid changes, process third-party billing and maintain inventory control and accounts receivable. Rush Pharmacies is a three-branch division of Niemerow Pharmacies Incorporated, headed by Dr. Lawrence Niemerow. The computer system is a turnkey system from Management System Technology, Inc. that uses proprietary software and Hewlett-Packard Company hardware.

When a patient is admitted to one of the nursing homes, a pharmacist obtains a list of allergies and other medical data which is entered into the computerized patient profile; verification is accomplished visually on a CRT at the time the data is entered. When a prescription is entered, validity checks are performed by the computer to block the entry of incorrect information. A scan is also made for possible allergies and adverse interactions of the prescribed drug.

Other features of the program include flagging attempts to refill prescriptions prematurely or to duplicate prescriptions. If the prescription passes the program checks, a label is printed, which will include a warning if allergy or adverse interaction is possible. A nurse or physician is called to verify the validity of the warning so that the prescription can be changed if necessary.

Outputs include a monthly medication administration record for each patient, a physician's order record, and drug inventory balances. Labels are also printed with can be used on reorder forms. The prescription label includes the patient's billing status, the associated hospital, number of days between refills, drug allergies and interactions. When the computer label is attached to unit dosage card, nurses can tell what medication has been given and what is outstanding. ■

Meetings

October 3-5, 1979: FIFTH INTERNATIONAL CONFERENCE ON VERY LARGE DATA BASES in Rio de Janeiro, Brazil. Contact: S. Su, Computer and Information Sciences Department, University of Florida, Gainesville, FL 32611.

October 6-10, 1979: 32ND CONFERENCE ON ENGINEERING IN MEDICINE AND BIOLOGY in Denver. Contact: Patricia I. Horner, Suite 404, 4405 East-West Highway, Bethesda, MD 20014.

October 10-15, 1979: ORSA/TIMS in Milwaukee. Contact: ORSA/TIMS, 428 East Preston Street, Baltimore, MD 21202.

October 14-17, 1979: 28TH INTERNATIONAL CONFERENCE AND BUSINESS EXPOSITION (DPMA) in San Diego. Contact: Carole Harte, DPMA, 505 Busse Highway, Park Ridge, IL 60068.

October 15-18, 1979: INFO in New York City. Contact: Clapp & Poliak, Inc., 245 Park Avenue, New York, NY 10017.

October 22, 1979: SYMPOSIUM ON COMPUTERS IN DENTISTRY (FEDERATION DENTAIRE INTERNATIONALE) in Paris. Contact: Dr. Alain Deyrolle, Association Dentaire Francaise, 19 bis rue Legendre, 75017 Paris, France.

October 22-24, 1979: NINTH ANNUAL CONFERENCE OF THE ASSOCIATION OF COMPUTER PROGRAMMERS AND ANALYSTS in Washington. Contact: K. Burroughs, DBD Systems, Inc., 1500 N. Beauregard St., Alexandria, VA 22311.

October 23, 1979: SEMINAR ON IMPACT OF COMPUTERS IN DENTAL PRACTICE (AMERICAN DENTAL ASSOCIATION) in Dallas, TX. Contact: Daryl Miller, ADA, 211 East Chicago Avenue, Chicago, IL 60611.

October 29-31, 1979: ACM 79 in Detroit. Contact: Mayford L. Roark, Ford Motor Company, The American Road, Room 895 WHQ, Dearborn, MI 48121.

November 4-8, 1979: AUTO-CARTO IV, INTERNATIONAL SYMPOSIUM ON CARTOGRAPHY AND COMPUTING: APPLICATIONS IN HEALTH AND ENVIRONMENT in Reston, VA. Contact: James Smith, Conference Management Branch, NCHS, Room 2-12, Center Bldg., 3700 East-West Highway, Hyattsville, MD 20782.

November 6-8, 1979: FEDERAL COMPUTER CONFERENCE in Washington. Contact: Ms. Lynn S. Green, Federal Computer Conference, Wayland, MA.

November 12-14, 1979: SIAM 1979 FALL MEETING in Boulder, CO. Contact: H. B. Hair, SIAM, 33 S. 17th St., Philadelphia, PA.

November 14-16, 1979: FIRST INTERNATIONAL MICRO AND MINI COMPUTER CONFERENCE in Houston, TX. Contact: S. C. Lee, Dept. of Electrical Engineering and Computing Sciences, University of Oklahoma, 202 W. Boyd, Norman, OK 73019.

November 15-16, 1979: THIRD WESTERN EDUCATIONAL COMPUTING CONFERENCE in San Francisco. Contact: Ron Langley, Computer Center, California State University, 1250 Bellflower Blvd., Long Beach, CA 90840.

November 18-21, 1979: 12TH ANNUAL MICROPROGRAMMING WORKSHOP in Hershey, PA. Contact: Richard A. Belgard, Data General Corp., 62 Alexander Dr., Research Triangle Park, NC 27709.

December 3-5, 1979: 1979 WINTER SIMULATION CONFERENCE in San Diego. Contact: Mitchell G. Spiegel, Deputy Director, Dept. of Air Force, FEDSIM/NA, Washington, DC 20330.

January 3-4, 1980: 13TH ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES in Honolulu. Contact: Ralph Spargue, University of Hawaii, School of Business Administration, 2404 Maile Way, Honolulu, HI 96822.

January 3-8, 1980: ANNUAL MEETING, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE in San Francisco. Contact: AAAS, 1515 Massachusetts Avenue, NW, Washington, DC 20005.

January 9-11, 1980: 1980 CONFERENCE ON PATTERN RECOGNITION in Oxford, England. Contact: Josef Kittler, Nuclear Physics Laboratory, Keble Road, Oxford OX1 3RH, England. ■

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